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## **PILOTS TEST 'SYNTHETIC VISION' WITH WINDOWLESS LANDINGS**

NASA has flight tested a "synthetic vision" concept that promises to help make supersonic flight practical and affordable for the average air traveler close to the turn of the century. The tests, in which pilots conducted windowless landings, were flown on a NASA 737 research aircraft over a three-month period ending in January.

Sensors tested included a digital video camera, three infrared cameras, and two microwave radar systems. The video and infrared images were combined with computer-generated graphics that gave the pilot cues during approaches and landings. One goal of the tests is to identify sensors that will replace or exceed the capabilities of human vision.

The same technology will provide all weather flying capabilities for high speed civil transport and future subsonic transports, allowing pilots to fly and land safely in low visibility conditions. This will increase the number of flights in poor weather, reduce terminal delays and cut costs for the airline industry and passengers.

Researchers are hoping that by enhancing the pilot's vision with high-resolution video displays, aircraft designers of the future can do away with the expensive, mechanically-drooping nose of early supersonic transports. Forward-looking windows would be eliminated, making way for large-format displays filled with high-resolution images and computer graphics.

As envisioned, such an aircraft would carry about 300 passengers at speeds up to Mach 2.4, (about 1,400 mph) over a 5,000 nautical mile range. Travel time across the Pacific Ocean would be cut in half, with only an approximate 20 percent fare increase over current subsonic prices.

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The tests were flown on NASA's Transport Systems Research Vehicle (TSRV), a Boeing 737 equipped with a windowless research cockpit, and a Westinghouse BAC 1-11 avionics test aircraft. About 20 flights took place from NASA's Wallops Flight Facility at Wallops Island, Va., and Langley Air Force Base in Hampton, Va.

The flight tests consisted of two phases. During the sensor data collection phase, the TSRV and BAC 1-11 flew typical approach, cruise and holding patterns and tested the suitability of sensors to detect airborne traffic and ground objects. During the pilot-in-the-loop phase, the TSRV flew approaches and landings from the research cockpit and tested the pilot's ability to easily control and land the aircraft relying only on the sensor and computer-generated images and symbology.

The flight tests are part of the HSR Program's Flight Deck Systems research effort, a part of which aims to develop technologies allowing airframe companies to design, build and certify a cockpit without forward facing windows. Such a cockpit is important to a high-speed civil transport because it would avoid the need to incorporate a Concorde-like drooped nose design, which adds weight and mechanical complexity and increases fuel required for every flight.

The TSRV is a Boeing 737 aircraft that has been modified to incorporate a research flight deck in the passenger section. This research aircraft has been operated by NASA for more than 21 years and has conducted pioneering flight systems and aeronautics research ranging from electronic flight displays to first-of-its-kind satellite navigation and guidance, to proving the viability of airborne wind shear sensors.

The HSR Flight Deck research team includes NASA Langley Research Center, Hampton, Va.; NASA Ames Research Center, Mountain View, Calif.; The Boeing Company, Seattle, Wash.; McDonnell Douglas Corporation, Long Beach, Calif.; and Honeywell Incorporated, Phoenix, Ariz. Subcontractors supporting the flight tests included Rockwell Collins, Cedar Rapids, Iowa; FLIR Systems, Portland, Ore.; and Westinghouse Electric Corporation, Md.

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